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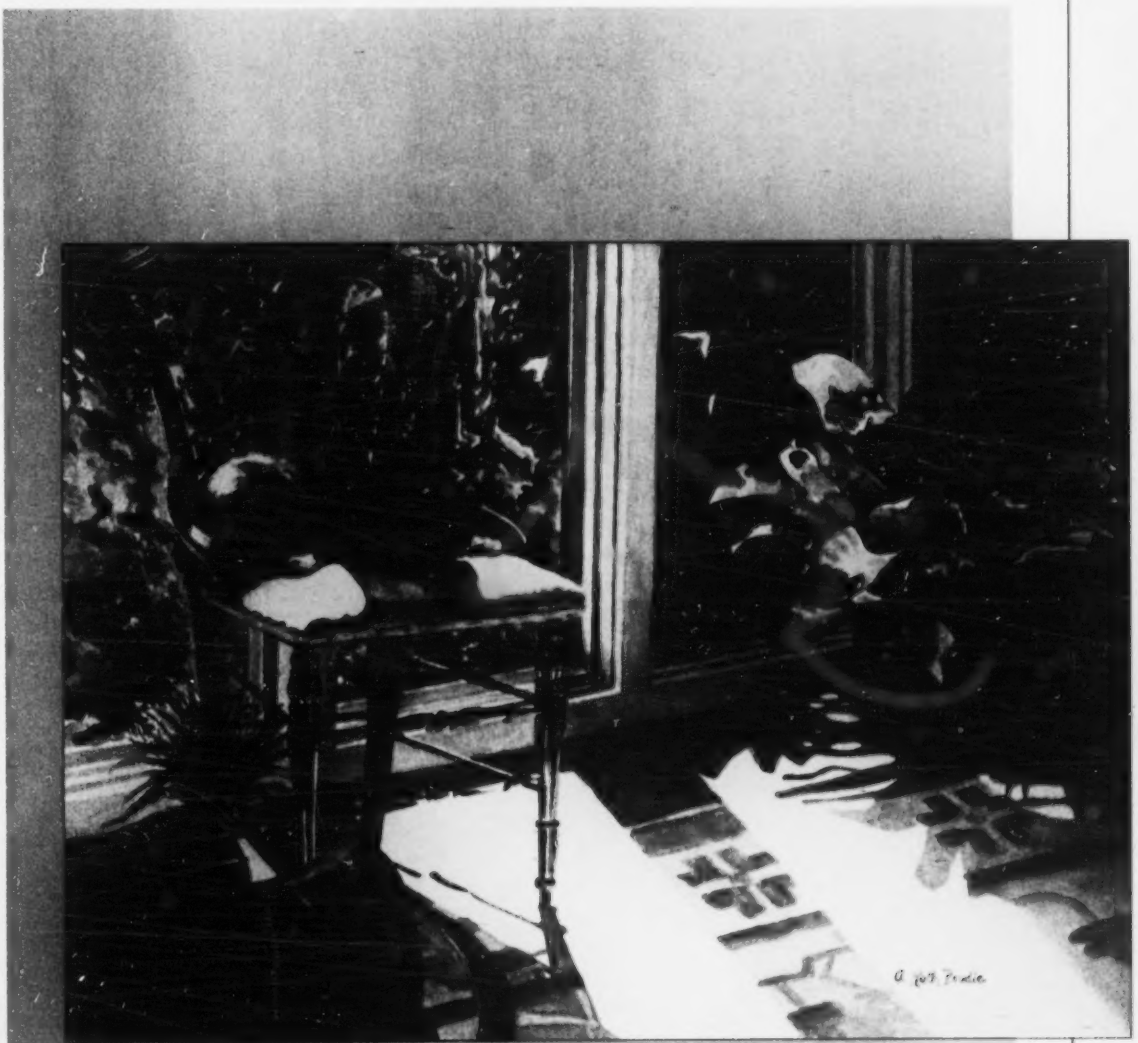

Miss Ellen's Porch — Anne Roth Brodie

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VBPA

Comparative study of the knowledge, attitudes, and behaviors of large animal veterinarians, dairy farmers, and dairy processors in Michigan on bovine somatotropin

Jane R. Shaw, BS; Edward C. Mather, DVM, PhD; Mary Margaret Noel, PhD

Summary: *A cross-sectional epidemiologic study was conducted to evaluate two objectives. The first was to determine the knowledge, attitudes, and behaviors of large animal (dairy) veterinarians, dairy farmers, and dairy processors in Michigan toward the use of bovine somatotropin (BST). The second was to compare and contrast the data from the large animal veterinarians, dairy farmers, and dairy processors according to the knowledge, attitude, and behavior variables.*

A written questionnaire was used as an instrument to collect data relating to the objectives. Three basic types of questions were asked of each group: (1) how much do you know about BST? (knowledge-based question), (2) how do you feel about BST? (attitude-based question), and (3) how would you use BST or use dairy products produced through BST biotechnology (behavior-based question)?

Over the past decade, there have been numerous studies of scientific merit on bovine somatotropin (BST). Some information is known about the dairy industry's reaction toward the use of BST, and several studies have been performed to assess the reaction of consumers to the use of BST.[1,2] Few of these studies aid the development of a comprehensive and organized information system. There are many questions that are still unanswered. It is not known what kind of impact BST will have on society, how the dairy industry will respond to BST, or how consumers will respond to BST.

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This study was supported in part by a National Institute of Health Biomedical Summer Research Program grant. The authors thank Anne Woodard, Diane Leslie, MaryEllen Shea, and Debbie Richardson for technical assistance, and Dr. John B. Kaneene for statistical advice.

The objectives of the study reported here were to determine the knowledge, attitudes, and behaviors of large animal (dairy) veterinarians, dairy farmers, and dairy processors in Michigan, and to compare and contrast data from the large animal veterinarians, dairy farmers, and dairy processors according to the knowledge, attitude, and behavior variables. To accomplish these objectives, a cross-sectional epidemiologic study was designed.

The use of BST in the dairy industry is highly controversial. Bovine somatotropin is a natural protein hormone composed of approximately 190 amino acids,[1] is manufactured through recombinant DNA technology, and when injected into dairy cows, can increase milk production by 10 to 25%.[2] It increases milk production by altering the partitioning of nutrients, sparing the utilization of glucose and amino acids in synthesis of milk components and promoting the utilization of fatty acids as an energy source.[3]

The hormone is regulated by the FDA from three safety aspects: target animal safety, human food safety, and environmental impact.[4] Juskevich and Guyer[5] reported that so far, the FDA scientists concluded that the use of BST in dairy cattle presents no increased health risk to consumers. In addition, the National Institute of Health and Congressional Office of Technology Assessment have determined that BST is safe for human consumption and has no adverse health effects for the dairy cow.[1,6,7] Independent researchers have also concluded BST-treated cows did not have any adverse health effects.[8,9,10] They reported BST-treated cows were similar to high-producing dairy cows in metabolic processes and homeostatic mechanisms to the point that high-producing cows may serve as models for predicting health and nutrient requirements for BST-treated cows.[10,11,12] However, FDA approval of general use of BST is still pending, awaiting further information on target animal safety and environmental safety.

Proponents of BST use claim that use of BST increases milk production and feed efficiency, leading to a decrease in milk production costs.[2] Therefore, it should increase the overall efficiency of dairy operations.

It has been stated that an efficient farmer can cut operating costs by using the hormone, because fewer cows are needed to produce the same amount of milk.[13] In addition to increased farm efficiency, increased milk production may also decrease the price of milk on the supermarket shelf for the consumer.[5]

The FDA approval of BST is a small step, compared with the preparation society needs to face the implications of the use of BST. The big step is the preparation of an information infrastructure.[14] McGuirk et al[2] concluded from their consumer survey that because of concerns such as the creation of an even greater milk surplus, loss of dairy farmers and decreased consumption of dairy products by consumers with the introduction of BST, veterinarians, agricultural scientists, and production economists will need to be proactive rather than reactive in planning strategies to prepare for FDA approval of BST. In other words, information science must keep pace with biotechnology.[14]

Methods

A written questionnaire was designed to assess the three variables of this study, knowledge, attitudes, and behaviors for veterinarians, dairy farmers, and dairy processors. A separate questionnaire was designed for each group. Each questionnaire had a similar format to allow for comparison and contrast between the groups. Initial questions asked for demographic information and were followed by questions based on knowledge, attitude, and behavior.

Three basic types of questions were asked of each group: (1) how much do you know about BST? (knowledge-based question), (2) what do you think about BST? (attitude-based question), and (3) how would you use BST or use dairy products produced with BST biotechnology (behavior-based question)? A cover letter accompanied each questionnaire. The study was approved by the University Committee on Research Involving Human Subjects at Michigan State University. The questionnaire was pretested with large animal (dairy) clinicians and students with a dairy background at the College of Veterinary Medicine at Michigan State University.

A representative sample of 1,000 dairy farmers was randomly selected by Michigan Agricultural Statistical Service from approximately 5,000 dairy farmers in Michigan. Mailing addresses for all 246 veterinarians involved in dairy practice in Michigan were provided by the Michigan Veterinary Medical Association (MVMA). This list included MVMA members and potential members. The potential member category included past members, new graduates, and veterinarians new to the state of Michigan.

Veterinarians selected for the sample were classified as food animal practitioners or mixed animal practitioners by the MVMA. Most of them (71.2%) were mixed small animal/equine/food animal practitioners. The remaining veterinarians were food animal (9.3%), small animal/food animal (13.8%), and equine/food animal (5.7%) practitioners.

Mailing addresses for all 55 dairy processors in Michigan were provided by the Michigan Agricultural Statistical Service and the Michigan Dairy Foods Association. Total dairy farmers surveyed was 989. Total veterinarians surveyed was 245. The overall number receiving the survey was 1,289.

Questionnaires, cover letters, and self-addressed stamped return envelopes were mailed to the survey population on June 15, 1991. Approximately one month later, reminder cards were sent to everyone. A month later, reminder cards were sent again to only the dairy processors, because their return rate was low for such a small group. Cost prohibited sending reminder cards again to dairy farmers and veterinarians. The data received were entered into a Lotus spreadsheet program, organized, and summarized.

The knowledge variable of the study was defined as specific information about BST.[15] Knowledge questions were phrased either as a statement or a question and three responses could be chosen—yes, no, or I don't know. For example, a knowledge question was, "Is BST normally found in the blood of a dairy cow?"

Attitude was defined as a state of mind or feelings with regard to BST.[15] Attitude questions contained the verbs "think" or "believe" or the phrase "change your mind." For example, one attitude question was, "Do you think milk produced through the use of BST biotechnology in dairy herds is safe for human consumption?"

Behavior was defined as actions or reactions of persons or things under specified circumstances with respect to BST.[15] Behavior questions contained the verbs "use," "drink," "promote," "recommend," and "offer." For example, a behavior question used was "Will you drink milk produced with BST biotechnology?"

Results and Discussion

Response rates for veterinarians, dairy farmers, and dairy processors were 55.1%, 34.9%, and 32.7%, respectively. Although greater response rates are desirable, these response rates are typical of similar questionnaires. Because the data represent a sizeable number of respondents (498) from a single geographic region, the results contribute to a meaningful and important study.

Demographics—Seventy-nine percent of dairy farmers that responded to the questionnaire were

Table 1—Sample demographic characteristics

Variable	Dairy farmers n = 345 (%)		Veterinarians n = 135 (%)		Dairy processors n = 18 (%)	
Age (years)	a	b	a	c	a	d
<30	5.5	2.8	5.2	6.4	16.7	
30 to 39	25.8	20.2	37.8	36.1	11.1	
40 to 49	28.4	26.9	34.8	33.9	22.2	NA
50 to 59	20.0	27.5	14.1	13.3	22.2	
>59	13.6	22.6	7.4	10.3	22.2	
Gender						
M	88.1		88.1	86.2	94.4	
F	4.9	NA	11.1	13.8	5.6	NA

n = total number responding to survey.
a = analysis of sample population in study; b = Michigan dairy farmers.[19] c = Michigan Veterinary Medical Association 1990 data of Michigan Veterinarians; d = No corresponding total population identified.
NA = data not available.

Table 2—Response to questions testing knowledge of bovine somatotropin (BST)

Question	Dairy farmers n = 345 (% correct)	Veterinarians n = 135 (% correct)	Dairy processors n = 18 (% correct)
Is BST normally found in the blood of a dairy cow? (Yes)	55.9	74.1	44.4
Can BST effectively be given by mouth to dairy cows? (No)	38.3	64.4	22.2
BST is produced by the posterior pituitary and regulated by somatostatin. (No)	1.7	13.3	0
BST has been shown to be active in human beings. (No)	22.3	54.8	22.2

n = total number responding to survey.

owners or operators of the dairy farm (Table 1). In addition, 40% of veterinarians spent 51 to 100% of their time on dairy-related activities. Despite the sampling method, which aimed at targeting large animal (dairy) veterinarians, 29% of the respondents spent 0 to 10% of their time on dairy-related activities.

Knowledge—Veterinarians scored the highest overall on the knowledge questions, followed by dairy farmers, and then dairy processors (Table 2). The question stating, "BST is produced by the posterior pituitary and regulated by somatostatin," was intended to be the most difficult question. Dairy farmers and dairy processors were not expected to answer this question correctly because most lack training in physiology. Veterinarians, however, because of their training, were expected to correctly answer this question. Yet, only 13% of veterinarians correctly answered this question.

Attitudes—As a follow-up to the question on the use of BST, dairy farmers were asked what situations would cause them to change their minds about use of BST. The most prevalent one is a change in the milk surplus or the price of milk (37%). If there was no longer a milk surplus or if there was a need for increased milk production, dairy farmers would be more likely to adopt use of BST.

*Table 3—Situations that would cause respondents to change their mind about the use of BST**

Situation	Dairy farmers n = 345 (%)	Veterinarians n = 135 (%)	Dairy processors n = 18 (%)
Consumers' acceptance of BST	24.1	40.5	100.0
Acceptance of BST becoming an economic necessity	26.5	43.2	40.0
New information is released on product safety	16.9	43.2	80.0

*Responses to the question: If you would change your mind about the use of BST, what are the situations that would cause you to change your mind?
n = total number responding to survey.

Likewise, if the price of milk increased, dairy farmers would be more likely to adopt use of BST. This response may reflect the low price for milk during the summer of 1991.

Twenty-six percent of dairy farmers reported they would accept use of BST if it became an "economic necessity." These farmers would adopt use of BST to remain competitive in the milk market. On the other hand, 25% of dairy farmers responded there are no situations that would cause them to change their minds about BST. These farmers would not use BST no matter what the situation.

In addition, 24% of dairy farmers would change their mind about BST if consumers accept the use of BST in dairy products. Furthermore, 17% of dairy farmers would change their mind about BST if new information on product safety was released (Table 3).

Several situations would cause veterinarians to change their minds about BST: the release of new data on the safety of the use of BST (43%); if farmers needed to use BST to remain competitive in the milk market, some veterinarians would be more likely to recommend it (43%); and 40% would recommend it if consumer consumption of dairy products did not change with the use of BST (Table 3).

All the processors surveyed said consumer acceptance would change their views about BST use. If consumer consumption of dairy products did not change with the use of BST, dairy processors would use milk produced with BST biotechnology in their dairy plants. New information on product safety (80%) and government regulation of BST (80%) were also situations that would cause dairy processors to change their minds (Table 3).

Veterinarians, followed by dairy processors, then dairy farmers, were confident use of BST in milk production is safe for human consumption. Likewise, veterinarians, followed by dairy farmers, then dairy processors, were confident use of BST is safe for dairy cows. Dairy processors and veterinarians who said they were not comfortable with

Table 4—Response to questions testing attitudes towards BST

Question	Dairy farmers n = 345 (% yes)	Veterinarians n = 135 (% yes)	Dairy processors n = 18 (% yes)
Do you think milk produced through the use of bovine somatotropin (BST) in dairy herds is safe for human consumption?	40.9	71.1	64.7
Do you think the use of BST is safe for your dairy cows?	33.6	66.7	27.8
If your answer was no to using or recommending BST, or using milk produced through BST biotechnology, are there any situations that would cause you to change your mind?	24.1	27.4	27.8
Should BST be given Food and Drug Administration approval as a scientifically safe product?	30.7	59.3	33.3

n = Total number responding to survey.

Table 5—Positive responses to behavior questions

Question	Dairy farmers n = 345 (%)	Veterinarians n = 135 (%)	Dairy processors n = 18 (%)
Would you use BST in your dairy herd?	24.1	...	...
Would you recommend the use of BST to the dairy herds you serve?	...	50.4	...
Would you use BST-produced milk in the dairy products you process?	...	...	44.4
Will you drink milk produced through BST biotechnology?	39.4	73.3	72.2

n = Total number responding to survey.

BST-use indicated a greater willingness to change their minds about BST than did dairy farmers (Table 4).

Behavior—Twenty-four percent of dairy farmers responded that they would use BST (Table 5). Thirty-nine percent stated they would drink milk produced with BST biotechnology. Only 21% said they would promote the use of BST in their dairy cooperative. Further studies are needed to understand or explain these responses to the behavior questions and to determine whether the trends are changing.

Dairy farmers would want to select cows for BST use primarily on their condition score and reproductive status. They favored six weeks after calving as the stage in the lactation cycle to use BST. This corresponds to Weaver's recommendation that treatment be delayed until after the usual period of postpartum energy deficits.[16] This period is approximately six weeks after calving.[17] Other conditions in which dairy farmers would use BST included: 90 to 100 days after calving and under the direction of a veterinarian, a feed consultant, or the manufacturer. Also, use of BST would depend on the economic factors of the situation (Table 6).

The foremost reason why farmers would never use BST is because they think there is already too much milk. This corresponds to Schmidt's suggestion that low milk prices and high feed prices would not be conducive to the use of BST.[18] With the low prices for milk in the summer of 1991, farmers did not see a need for increased milk production. The second most frequently stated reason was the use of BST will place too much stress on the cows. Farmers said increasing milk production through use of BST will stress cows, leading to further health complications. The third most frequent response of dairy farmers was that BST is not natural. This response indicated farmers simply did not subscribe to the idea of injecting cows with BST to increase milk production.

*Table 6—Variables that would be positively considered in the use of BST**

Conditions or circumstances	Dairy farmers n = 345	Veterinarians n = 135
Body condition score	57.8	79.4
Reproductive status	51.8	48.5
6 weeks after calving	32.5	39.7
Age	16.8	17.6
Use on all cows	9.6	10.3
High butterfat cows	8.4	4.4
Top-producing cows only	8.4	13.2
4 to 6 weeks after calving	9.6	14.7
2 weeks after calving	6.0	7.3

*Responses to question: How would you use BST (dairy farmers) or How would you recommend the use of BST to the dairy herds you serve (veterinarians)?

Fifty percent of veterinarians responded that they would recommend use of BST. Seventy-three percent said they would drink milk produced with BST biotechnology (Table 5). In addition, 38% of veterinarians would offer BST for sale if it was available as a nonprescription product. However, 45% would not offer BST for sale under that circumstance. Of those who would not offer BST for sale as an over-the-counter drug, 24% would recommend the purchase of BST from another source.

Veterinarians would recommend use of BST six weeks after calving and select cows for BST use on the basis of condition score and reproductive status. Other recommendations suggested by veterinarians included the use of BST 80 to 100 days after calving, nonuse of BST on sick cows, and the use of BST according to the manufacturer's recommendation (Table 6).

The most important criteria veterinarians would use to recommend BST were the management abilities of the farmers, health of the herd, scientific skills of the farmer, and economic viability of the herd/farm (Table 7). According to the veterinarians in this study, dairy farmers with excellent management skills, strong scientific skills, healthy herds, and financially stable businesses were the strongest candidates for the use of BST. Another criterion mentioned by veterinarians was the nutritional status of the herd.

It has been suggested that quality of management will be the major factor affecting the magni-

Table 7—Criteria veterinarians would use in recommendation of BST use (n = 135)*

Criteria	Response (%)
Management abilities	74.1
Health of herd	65.2
Scientific skills of farmer	52.6
Economic viability of herd/farmer	49.6
Pounds of milk produced/year	32.6
Quality of milk	25.2
Other	16.3
Size of herd	13.3
No criteria	8.9

*Responses to the question: What are the criteria you would use to make a recommendation to use BST?

tude of response.[17] The magnitude of the response to BST is dependent on the managerial skills of the dairy farmer. Therefore, excellent managers should receive the greatest response from the use of BST in their dairy herds.[17]

Other factors to be considered in determining whether BST should be used in a particular herd included owner bias, management capabilities, herd genetics, production history, feedstuffs available, and herd records.[16] In addition, practitioner involvement will be critical in ensuring that expected responses to treatment are observed and in identifying and discriminating among successful BST management strategies.[16]

Therefore, it is suggested that practitioners who are proactive and informed about BST will better fulfill their role as production consultants to the dairy farmer.[16] It has been further suggested that if recombinant BST is adopted, veterinarians will need to discuss new approaches to herd management.[8] Some of these new approaches are an enhanced understanding of dairy nutrition to meet the needs of high-producing dairy cows given BST, rigorous reproductive programs to account for the possibility of impaired fertility, and strong economic background to provide sound advice and services to farms that used BST.[8]

Veterinarians and other agricultural scientists must be prepared for the impact of the impending BST technology. In an economic survey it was determined that BST will be an economic alternative for dairy farmers who have the ability to feed and manage higher producing dairy cows.[18]

Veterinarians who would never recommend use of BST stated the following reasons: excessive surplus milk supplies, concern over decreased consumer consumption of dairy products, concern that milk production with BST use is not natural, concern that more information on product safety is needed, and concern that farmers needed to have better management skills.

Dairy processors who would never use milk produced through BST biotechnology would do so for only one reason, decreased consumer consumption of dairy products. These respondents stated consumers do not want milk produced through BST biotechnology and recognize the potential consumer rejection of dairy products that contain milk produced with BST biotechnology.

Veterinarians were more positive about the use of BST than dairy processors and dairy farmers. Veterinarians and dairy processors were far more likely to drink milk produced with BST biotechnology than were dairy farmers. Dairy farmers and veterinarians agreed the most important determinants for use of BST were the condition score, the reproductive status of the dairy cow, and a time period beginning six weeks after calving.

Dairy farmers against the use of BST were primarily driven by the price of milk. Veterinarians against the use of BST were concerned about milk supply and consumer reaction. Dairy processors against the use of BST were also primarily concerned about a negative consumer reaction.

References

1. US Congress Office of Technology Assessment. *US dairy industry at a crossroad: biotechnology and policy choices*. OTA-F-470. Washington, DC: US Government Printing Office, 1991.

2. McGuirk AM, Kaiser HM. BST and milk, benefit or bane? *Choices* 1981;1:20–26.

3. Breier BH, Gluckman PD, McCutcheon SN, et al. Physiologic responses to somatotropin in the ruminant. *J Dairy Sci* 1991;74:20–34.

4. Apostolou A. Somatotropin safety—a short regulatory overview. *J Am Vet Med Assoc* 1988;192:1698–1700.

5. Juskevich JC, Guyer CG. Bovine growth hormone: human food safety evaluation. *Science* 1990;249:875–884.

6. Daughaday WH, Barbano DM. Bovine somatotropin supplementation of dairy cows, is the milk safe? *JAMA* 1990; 264:1003–1005.

7. National Institute of Health. NIH technology assessment conference statement on bovine somatotropin. *JAMA* 1991;265:1423–1425.

8. Lean IJ, Weaver LD, Troutt HF. Bovine somatotropin: management and industry implication. *Compendium Contin Educ Pract Vet* 1990;12:1150–1158.

9. Annexstad RJ. Somatotropin treatment for a second consecutive lactation. *J Dairy Sci* 1990;73:2423–2436.

10. Burton JL. Health and reproductive performance in dairy cows treated up to two consecutive lactations with bovine somatotropin. *J Dairy Sci* 1990;73:3258–3265.

11. Robinson PH, deBoer G, Kennelly JJ. Effect of bovine somatotropin and protein on rumen fermentation and forestomach and whole tract digestion in dairy cows. *J Dairy Sci* 1991;74:3503–3517.

12. Miller PS, Reis BL, Calvert CC, et al. Patterns of nutrient uptake by the mammary glands of lactating dairy cows. *J Dairy Sci* 1991;74:3791–3799.

13. Sun M. Will growth hormone swell milk surplus? *Science* 1986;233:150–151.

14. Kronfeld DS. Biologic and economic risks associated with use of bovine somatotropin. *J Am Vet Med Assoc* 1988; 192:1693–1696.

15. Anonymous. *American heritage dictionary*. Boston, Mass: Houghton Mifflin Co, 1988;140, 168, 705.

16. Weaver LD. Health programs for productivity using bovine somatotropin, in *Proceedings* Annu Conv Am Assoc Bovine Pract 1990;88–91.

17. Hutjens MF. Nutritional aspects of bovine somatotropin, in *Proceedings*. Annu Conv Am Assoc Bovine Pract 1990;81–85.

18. Schmidt GH. Economics of using bovine somatotropin in dairy cows and potential impact on the US dairy industry. *J Dairy Sci* 1989;72:737–745.

19. Conner LJ, Hamm LG. Michigan dairy farm industry: summary of the 1987 Michigan State University dairy farm survey. Michigan State University-Agriculture Experimentation Station, Research Report 498, 1989;1–36.